THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 32

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

_____

Ex parte FRANK M STEPHENS, JR.

_____

Appeal No. 96-2884
Application 08/181,997,[1]

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HEARD: FEBRUARY 2, 1998

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Before Downey, Warren and Owens, Administrative Patent Judges.

Downey, Administrative Patent Judge.

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134 from the final rejection of claims 1-41, all the claims pending in the application.

[1] Application for patent filed January 14, 1994.

The subject matter on appeal is directed to a two step process for the production of iron carbide from iron oxide. The independent claims, claims 1, 23 and 41, set forth three embodiments of the claimed invention each of which recites the use of hydrogen in the first step to reduce the iron feed to a metallic iron product and various combinations of gases in the second step to convert the metallic iron product to iron carbide. In addition, claim 41 recites the inclusion of a carbon containing gas to the first step. The independent claims are illustrative of the claims on appeal and are reproduced in the appendix to this decision.

Appellant has indicated that all the claims do not stand or fall together with respect to rejections I, III-V (see, infra). Accordingly, the grouping of claims as set forth in the brief will be addressed with the respective rejections.

The references relied upon by the examiner are:

Okamura et al. (Okamura)	4,668,414	May 26, 1987
Stephens et al. (Stephens)	5,073 194	Dec. 17, 1991

The rejections before us are:

I. Claims 5, [sic: 9,[2]] 18, 19, 34, 38 and 39 stand rejected under 35 U.S.C. 112, second paragraph.

II. Claims 24, 30, 35 and 36 stand rejected under 35 U.S.C. 112, first paragraph, description requirement.

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[2] In both the final rejection and examiner's answer the primary examiner identified claim 9 as unclear; however, he did not recite claim 9 in the statement of the rejection. Appellant has argued the merits of this rejection with respect to claim 9. Accordingly, we treat claim 9 as part of this rejection.

III. Claims 1, 5, 6, 9, 14, 15, 18 and 19 stand rejected under 35 U.S.C. 102(b) as anticipated by Okamura.

IV. Claims 1, 3, 5, 6, 8-21, 24, 26-32 and 34-40 stand rejected under 35 U.S.C. 103 over Okamura.

V. Claims 1, 2, 4-7, 9, 13-25 and 33-41 stand rejected under 35 U.S.C. 103 over Okamura with Stephens.

After careful consideration of the rejections before us, the prior art, the arguments presented by appellant and the examiner as well as the evidence (Example 2 in the specification), we affirm rejection II; and rejections IV and V as applied to claims 1, 3-18, 19-26, and 28-40; and we reverse rejection I; rejection III; and rejection IV as applied to claim 27 and rejection V as applied to claims 2 and 41.

A.

Preliminarily, we note that appellant's brief presents arguments directed to the primary examiner's refusal to enter appellant's amendment after final rejection. This matter is not properly before us. 37 C.F.R. § 1.181. See also MPEP §§ 1002 and 1201 which indicates that such issues are petitionable matters.

B.

35 U.S.C. § 112, first and second paragraph rejections

I. Claims 5, 9, 18, 19, 34, 38 and 39 stand rejected under 35 U.S.C. 112, second paragraph. Appellant argues claims 5 and 9 separately from claims 18, 19, 34, 38 and 39 (Brief, page 7). We reverse this rejection.

During examination "claims in an application are to be given their broadest reasonable interpretation consistent with the specification." In re Sneed, 710 F. 2d 1544, 1548, 218 USPQ 385, 388 (Fed. Cir. 1983) (emphasis added). Claim definiteness depends on whether the inventor's claim language conveys to those skilled in the art the scope of coverage. In re Credle, 25 F.3d, 1566, 1576, 30 USPQ2d 1911, 1919 (Fed. Cir. 1994).

As to claims 18, 19, 34, 38 and 39 the examiner contends that the phrase "an equilibrium concentration " is unclear as to its meaning or the basis for determining it. The examiner believes that perhaps appellants meant to say "the equilibrium concentration".

We cannot agree with the examiner that the expression "an equilibrium concentration" is indefinite[3]. One of ordinary skill in the art would understand the meaning of "an equilibrium concentration" with respect to the first gas, hydrogen, and a second gas in that the individual named gases and implicitly other gas components will react to produce a balance of gases in the system.

As to claim 18, the examiner also contends that the phrase "further comprises" implies more gas but "no more than" still includes zero, and thus claim 18 is

[3] In the event of further prosecution, the examiner should consider whether the expression "an equilibrium concentration" of two gases satisfies the description requirement or whether the expression is broader than the enabling disclosure (35 U.S.C. § 112, first paragraph).

unclear. We are not persuaded by this reasoning. Claim 1, from which claim 18 depends, requires the use of gas containing hydrogen in the first step. Claim 18 requires that the first step ”further comprises” another gas, which may be carbon monoxide, carbon dioxide, or methane. When the phrase “no more than...one ” is interpretated as zero, then claim 18 states no more than claim 1. However that does not make the claim unclear but rather indicates to one of ordinary skill in the art that claim 18 embraces two embodiments, the first where no gas is added and second where some gas is added. Accordingly, we find the claim to be sufficiently definite with respect to the controverted phrases.

As to claims 5 and 9, the examiner contends that the term “primary” in claims 5 and 9 is unclear. We agree with the appellants that one of ordinary skill in the art would know that the term “primary”, given it’s ordinary dictionary meaning, would indicate that a fundamental or basic byproduct of the process is water in claim 9 and similarly that the fundamental or basic source of carbon in the first component is carbon monoxide or carbon dioxide in the embodiment of claim 5. Lantech Inc. v. Keip Machine Co., 32 F.3d 542, 547, 31 USPQ2d 1666, 1670 (Fed. Cir. 1994), quoting Envirotech Corp. v. Al George, Inc., 730 F.2d 753, 759, 221 USPQ 473, 477 (Fed. Cir. 1984). (Terms in claims “will be given their ordinary and accustomed meaning, unless it appears that the inventor used them differently.”).

II. Claims 24, 30, 35 and 36 stand rejected under 35 U.S.C. 112, first paragraph, description requirement. All the claims are argued together (brief, page 7).

The examiner contends that the new ranges now claimed with respect to the temperature of the second gas (claim 24) and the phrase "no more than" (claims 30, 35 and 36) are not supported by the originally filed specification. We affirm this rejection.

The function of the description requirement is to ensure that the inventor had possession, as of the filing date of the application relied on, of the specific subject matter later claimed by him. In re Edwards, 568 F.2d 1349, 1351, 196 USPQ 465, 467 (CCPA 1978). To comply with the description requirement it is not necessary that the application describe the claimed invention in ipsis verbis, In re Lukach, 442 F.2d 967, 968-69, 169 USPQ 795, 796 (CCPA 1971); all that is required is that it reasonably convey to persons skilled in the art that, as of the filing date thereof, the inventor had possession of the subject matter later claimed by him. In re Driscoll, 562 F.2d 1245, 1247, 195 USPQ 434, 437 (CCPA 1977).

Contrary to appellant's argument, we do not find that appellant's specification, at page 23, lines 8-11 and page 21, line 25-page 22, line 2, supports the now claimed ranges. The language at page 23, lines 8-11 refers to the temperature of the first product, not the temperature of the second gas. The language in the

specification at page 21, line 26-page 22, line 2 states that the mole percent of free carbon is “less than... one” and the mole percent of iron oxide is “less than .... five”. Since the expression “ no more than ...one [or five]”, now recited in the claims, includes one [or five] and the expression “less than... one” in the specification does not include one [or five], we find that appellant’s specification does not reasonably convey to persons skilled in the art that, as of the filing date thereof, that the inventor had possession of the now claimed subject matter.

C.
35 U.S.C. §§ 102 and 103 rejections

The prior art

Okamura is directed to a one or two step process for producing iron carbide which conjointly includes Fe_5CH_2, Fe_2C, $Fe_{20}C_9$, Fe_2C_2 and Fe_3C. We focus our attention on Okamura’s two step process[4].

[3] Okamura acknowledges that he has filed patent applications involving one step processes for producing iron carbide involving treating iron oxyhydroxides or acicular iron oxide with CO or a mixture of CO and H_2 at 250-400 C. (column 1, lines 5-11) Okamura’s one step process in ‘414 involves contacting iron oxyhydroxides or acicular iron oxide with a reducing and carbonizing agent containing carbon or with a mixture of reducing and carbonizing agents containing carbon and a reducing agent containing no carbon. In order to avoid the noted prior art, Okamura indicates that in either of these two embodiments the sole use of CO as the reducing and carbonizing agent is excluded. However, Okamura does indicate that in his one-step process, CO can be used conjointly with a second reducing and carbonizing agent. (see column 3, lines 27-29 and also Table 3, Example 23).

In the two-step process, Okamura, like appellant, contacts iron oxyhydroxides, e.g., geothite, hematite and magnetite, with a reducing agent containing no carbon to form an iron compound. Typical examples of a reducing agent containing no carbon atom are H_2 and NH_2NH_2, etc. (see column 2, lines 62-63). The contact temperature, contact time, gas flow rates and other conditions in the first step are said to depend on production history, etc. (column 3, lines 34-39). Okamura teaches that the iron compound from the first step is then treated with a reducing and carbonizing agent containing carbon or a mixture thereof with a reducing agent containing no carbon. As useful reducing and carbonizing agents, Okamura identifies eight classes of compounds which include both CO and methane. Okamura also identifies particularly preferable reducing and carbonizing agents containing carbon to include CO, CH_3OH, $HCOOCH_3$, saturated or unsaturated aliphatic hydrocarbons having 1 to 5 carbon atoms. Contact conditions are suitably selected (see column 1, lines 37-41, column 2, line 64- column 3, line 17-20, lines 48-55). Okamura indicates that his process produces particles composed substantially of iron carbide alone, or iron carbide in combination with iron oxide and/or elemental carbon (column 4, lines 35-39). Okamura shows in his examples, the use of CO (Ex 1), methane (Example 3) and combinations of reducing and carbonizing agents (Example 13 where he employs propane and methanol) in the second step.

Stephens is also directed to a two step process for producing iron carbide. However in the first step, any (Fe_3O_4) iron oxide is oxidized to Fe_2O_3, the hematite form of

iron oxide, which form more readily converts to iron carbide. In the second step the hematite form of iron oxide, Fe_2O_3, is treated with a five species gas system, CO, CO_2, CH_4, H_2, and H_2O, to directly convert Fe_2O_3 to iron carbide. Stephens employs a fluidized bed as his reactor in his conversion processes.

The rejections

III. Claims 1, 5, 6, 9, 14, 15, 18 and 19 stand rejected under 35 U.S.C. 102(b) as anticipated by Okamura. We reverse this rejection.

The examiner contends that Okamura teaches reducing an iron feed free of iron carbide with hydrogen gas then with methane and/or CO and/or hydrogen. The examiner's contention is a short hand explanation which basically would indicate that Okamura describes seven different gas or gas combinations. According to the examiner, Okamura describes the use of (1) methane alone, (2) carbon monoxide alone, (3) hydrogen alone, (4) the combination of methane and carbon monoxide, (5) the combination of carbon monoxide and hydrogen, (6) the combination of methane and hydrogen and (7) the combination of methane, carbon monoxide and hydrogen as the gas or gases in the second step of his process. We focus our attention of gas combination (7) with respect to claim 1 and the rejection before us since claim 1 requires in the second step a combination of gases, to include, (a) carbon monoxide, hydrogen and methane (b) carbon dioxide, hydrogen and methane and (c) carbon monoxide, carbon dioxide, hydrogen and methane.

Anticipation of a method claim occurs if all of the steps of the claim, in the recited combination of steps and otherwise considering the claim as a whole, are found in a single prior art reference of the type defined in 35 U.S.C. 102. RCA Corp. v. Allied Digital Data Sys., Inc.,730 F.2d 1440, 1444, 221 USPQ 385, 388 (Fed. Cir. 1984). Every limitation positively recited in a claim must be given effect in order to determine what subject matter that claim defines under 35 U.S.C. 102. In re Wilder, 429 F.2d 447, 450, 166 USPQ 545, 548 (CCPA 1970).

Herein we agree with appellant that Okamura does not anticipate the claimed invention. Initially we note that the examiner has not pointed out wherein Okamura describes the specific gas combination of carbon monoxide and/or carbon dioxide, methane, with hydrogen in the second step. The examiner cites column 1, lines 40-65, column 2, lines 60-68, col. 3, lines 35-50 and column 9, line 55 and argues that the claimed materials are explicitly recited by Okamura (answer , page 7). However, in our view, Okamura' s listing of eight classes of useful reducing and carbonizing agents with exemplary compounds (column 2, line 60 through column 3, line 16), employed in the second step of the process, does not provide the necessary description of the claimed gas combinations to constitute an anticipation. "Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim" (emphasis added). Lindemann Maschinenfabrik GMBH v. American Hoist and Derrick Co., 730 F.2d 1452, 1458, 221 USPQ 481, 485 (Fed. Cir. 1984).

IV. Claims 1, 3, 5, 6, 8-21, 24, 26-32 and 34-40 stand rejected under 35 U.S.C. § 103 over Okamura and claims 1, 2, 4-7, 9, 13-25, 33-41 stand rejected under 35 U.S.C. § 103 over Okamura taken with Stephens. We affirm these rejections as to claims 1, 3-26, 28-40[5] and reverse these rejections as to claims 2, 27 and 41.

It is well settled that the Patent and Trademark Office (PTO) has the burden under 35 U.S.C. § 103 of establishing a *prima facie* case of obviousness. In re Piasecki, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984). This burden can be satisfied when the PTO, through the examiner, presents evidence by means of some teaching, suggestion, or inference either in the applied prior art or in generally available knowledge, that would have suggested the claimed subject matter to a person of ordinary skill in the art or would have motivated a person of ordinary skill in the art to modify the applied reference(s) in the proposed manner to arrive at the claimed invention. See In re Fine, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598-99 (Fed. Cir. 1988), Carella v. Starlight Archery, 804 F.2d 135, 139, 231 USPQ 644, 647 (Fed. Cir. 1986); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 304, 227 USPQ 657, 673 (Fed. Cir. 1985); In re Rinehart, 531 F.2d 1048, 1051, 189 USPQ 143, 147 (CCPA 1976).

As to claims 2, 27 and 41 which require the addition of a gas containing carbon to the first step of the claimed process, the examiner has failed to point out where

[4] We include claim 18 within the affirmance since, as drafted, it embraces both concepts of not adding a gas and adding some gas to the first step.

Okamura alone or in combination with Stephens teaches the addition of a carbon gas to the first step to convert an iron feed material to metallic iron product. Okamura specifically employs a reducing agent containing no carbon in the first step where he reduces the iron feed material to an iron product. Stephens employs hydrogen along with other gases to directly convert the iron oxide to iron carbide. Hence, neither Okamura nor Stephens provides any suggestion or motivation to add carbon gas to a step of reducing iron oxyhyroxides or iron oxides to a metallic iron product.

As to the remaining claims, 1, 3-26, and 28-40, we will affirm the rejection of the claims as unpatentable under 35 U.S.C. § 103 over Okamura alone or in combination with Stephens.

Appellant urges that Okamura does not suggest the use of a gas in the second step of the two-step process that contains carbon monoxide and/or carbon dioxide, hydrogen gas and methane (claim 1). We disagree. Initially we note that claim 23, requires carbon monoxide and/or carbon dioxide and methane. Claim 23 does not require the presence of hydrogen gas although it does not exclude it by virtue of the term “comprising.” In re Baxter, 656 F.2d 679, 686, 210 USPQ 795, 802 (CCPA 1981). As noted supra, Okamura specifically shows the individual use of carbon monoxide (example 1) and methane (example 3), in the second step of his process and he further identifies these particular reducing and carbonizing agents as preferred. (col. 3, lines 16-20). Okamura also teaches that reducing and carbonizing agents may be used in combination and demonstrates the

same in Example 13. Okamura further teaches the use of mixtures of carbonizing and reducing agents with a reducing agent containing no carbon atom in the second step of the process. (See column 1, lines 37-40). While Okamura does not have a working example directed to the combination of carbon monoxide and/or carbon dioxide, hydrogen and methane, we find Okamura's teaching of using carbon monoxide and methane individually as reducing and carbonizing agents along with his demonstration of using two reducing and carbonizing agents together and his teaching to combine reducing and carbonizing agents or mixtures thereof with a reducing agent sufficient to provide the suggestion and necessary motivation to combine carbon monoxide and methane with or without hydrogen to convert a reduced iron product to iron carbide in the Okamura process. In re Pinten, 459 F.2d 1053, 1055, 173 USPQ 801, 803 (CCPA 1972). Stephens demonstrates the use of a fluidized bed in the conversion of iron feed to iron carbide. Appellant does not controvert this teaching or the suggestion of using such bed in the Okamura process. Hence, the use of a fluidized bed in Okamura would have been *prima facie* obvious. Thus, the prior art provides the suggestion to make the claimed invention and the reasonable expectation of success. In re Dow Chemical Co., 837 F.2d 469, 473, 5 USPQ2d 1529, 1531 (Fed. Cir. 1990).

Appellant urges that Okamura fails to teach the formation of a product in the first step containing specified amounts of metallic iron (claims 11-13 and 26). Since, both appellant and Okamura treat the same iron feed material with hydrogen gas, one of ordinary skill in the art would expect production of the same product in the same or similar amounts.

Appellant argues that Okamura does not conduct the second step at a temperature ranging preferably from about 400°C(claim 16) and more preferably from about 500 to about 600EC (claim 24) . We do not find this argument persuasive. Initially we point out that the upper end of Okamura's preferred temperature, about 400°C overlaps that set forth in claim 16. In re Ayers, 154 F.2d 182, 184, 69 USPQ 109, 111 (CCPA 1946). Further, we point out that Okamura teaches that contact conditions are suitably selected. Hence, we do not read Okamura's teachings as limited to his preferred contact range, but rather to a wider range of temperatures. Moreover, it is our view that a person of ordinary skill in the art would know that higher temperatures would not be expected to alter the product but only accelerate the reaction. Appellant urges that Okamura does not disclose the concentrations of the gas compositions (claims 5, 15, 19, 29, 31-32, 34 and 38-39). Contrary thereto, Okamura does teach the use of a gas flow rate (preferred to be 1 to 1000ml S.T.P./min/ per gram of the starting iron) and also the mixing ratio of reducing and carbonizing agent and the reducing agent (suitably selected and preferably 0.05 to 1/5 by volume). Appellant describes his gas composition in terms of mole percent of different gases. However, appellant has not shown that Okamura's flow rates and mixing ratios are not those used in the instant claims. In re Best, 562 F.2d 1252, 1255, 195 U.S.P.Q 430, 433 (CCPA 1977). Appellant also urges that Okamura does not teach the formation of a product in the second step containing at least about 90 percent by weight of Fe_3C (claim 37) and of a highly pure product containing small concentrations of free carbon, iron oxide and metallic iron impurities (claims 21, 30, 35 and

36). We do not find this argument persuasive. With respect to the claims directed to iron carbide and to iron carbide containing a few impurities, Okamura teaches that the product produced is composed of iron carbide alone, or iron carbide and iron oxide and/or elemental carbon. When only iron carbide is produced, one would expect the product to be of high purity. Although, Okamura does not expressly disclose that the product produced is only Fe_3C, and the use of separate reaction zones, in cases of this type, where a person having ordinary skill would have reason to believe that the claimed and prior art processes are substantially identical, the burden of persuasion shifts to appellant "to prove that the subject matter shown to be in the prior art does not possess the characteristic relied on." In re Best, 562 F.2d at 1255, 195 USPQ at 433. Herein, appellant has made no direct comparison of his claimed process with that of Okamura's process, nor has he shown that the concentrations of carbonizing and reducing agents are different than that of the prior art.

Appellant urges that one of ordinary skill in the art would not combine Stephens and Okamura to solve problems addressed by present invention. The examiner relied upon Stephens for two reasons: (1) to use a fluidized bed and (2) to preheat the feed. Okamura teaches preheating the iron (column 1, lines 52-58) and in our view the use of a fluidized bed in the conversion of an iron material to iron carbide would have been prima facie obvious in view of Stephens teachings. Appellants do not controvert either of these positions. Rather they address the examiner's arguments wherein the examiner attempted to arrive at the claimed invention by relying upon Stephens teachings using a five component gas for

conversion of iron oxide to iron carbide. We agree with the appellant that one of ordinary skill in the art would not look to the Stephens' process of directly converting iron oxide to iron carbide with the named five gas composition in modifying Okamura's process of converting metallic iron product to iron carbide. However we remain of the view that the use of a fluidized bed in Okamura would have been prima facie obvious to one of ordinary skill in this art.

Appellant, we note, has offered Example 2 from his specification to establish unobvious results. Initially we point out that the presentation of evidence of nonobviousness does not, in and of itself, mandate a conclusion of nonobviousness. Cf. In re Chupp, 816 F.2d 643, 646, 2 USPQ2d 1437, 1440 (Fed. Cir. 1987); In re May, 574 F.2d 1082, 1092, 197 USPQ 601, 609 (CCPA 1978). Upon such presentation, it is necessary to consider anew the evidence of obviousness relied upon by the examiner and to weigh such against the evidence of nonobviousness relied upon by appellants. In re Johnson, 747 F.2d 1456, 1460, 223 USPQ 1260, 1263 (Fed. Cir. 1984).

The burden of persuasion is on the party asserting unexpected results. In re Klosak, 455 F.2d 1077, 1080, 173 USPQ 14, 16 (CCPA 1972). Hence, appellant must compare his invention with the closest prior art, show that the claimed process exhibits a difference, that the difference actually obtained is unexpected and of a practical advantage. In re De Blauwe, 736 F.2d 699, 705, 222 USPQ 191, 196 (Fed. Cir. 1984); In re Freeman 474, F.2d 1318, 1324, 117 USPQ 139, 143 (CCPA 1973); In re D'Ancicco, 439 F.2d 1244,

1247-48, 169 USPQ 303, 306 (CCPA 1971). Additionally appellant has the additional burden of explaining the evidence of nonobviousness proffered. In re Borkowski, 505 F.2d 713, 717, 184 USPQ 29, 32 (CCPA 1974).

In example 2, as a comparison, appellant reduces an iron feed material to metallic iron, and then he treats the metallic iron with a "gas composition containing carbon monoxide, carbon dioxide, hydrogen and methane, which composition is "... equivalent to the equilibrium gas composition at a selected point in the Fe_3C portion of Fig. 2". Appellant indicates that there is no conversion or little conversion to iron carbide. We have considered this evidence in the specification but do not find it persuasive of nonobviousness. From Okamura's teachings, one of ordinary skill in this art would have expected conversion of a reduced iron product to iron carbide with the use of a combination of reducing and carbonizing agents with a reducing agent. Moreover, from appellant's specification one would expect such conversion to occur as long as the gas composition was within the iron carbide portion of Figure 2. Appellant's example 2 shows that conversion occurs when the concentrations of the carbon monoxide and carbon dioxide are modified. Appellant now urges that the amount of carbon monoxide/carbon dioxide is crucial. However, the claims are not limited to this specific concentration of CO and CO_2. The instant claims read on the comparative gas composition and are not limited to the modified gas composition of Example 2 nor are all the claims limited to the formation of Fe_3C. Thus the evidence is not commensurate in scope with the degree of protection sought in the instant claims. In re

Grasselli, 713 F.2d 731, 743, 218 USPQ 769, 778 (Fed. Cir. 1983) and In re Lindner, 457 F.2d 506, 508, 173 USPQ 356, 358.

In summary, we affirm the rejections of claims 1, 3-26, 28-40 and reverse the rejections of claims 2, 27 and 41.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136 (a).

If there is further prosecution of the subject matter of this application in a continuation application, the primary examiner should evaluate whether the showing in Example 2 of the specification raises the question of whether the instant claims are broader than the enabling disclosure. 35 U.S.C. § 112, first paragraph. See our discussion with regard to this showing in C.III., supra.

AFFIRMED-IN-PART

MARY F. DOWNEY Administrative Patent Judge	)
CHARLES F. WARREN Administrative Patent Judge	) BOARD OF PATENT) APPEALS AND) INTERFERENCES
TERRY J. OWENS Administrative Patent Judge	)

Appeal No. 96-2884
Application No. 08/181,997

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APPENDIX

Claims 1, 23 and 41 are illustrative and read as follows:

1. A method for producing iron carbide, comprising the steps of:

(a) first contacting a feed material comprising iron with a first gas comprising hydrogen to produce a first product comprising metallic iron, wherein said first product contains no more than about 35 percent by weight iron carbide; and

(b) second contacting said first product with a second gas to produce a second product comprising iron carbide, wherein said second gas comprises (i) a first component selected from the group consisting of carbon monoxide, carbon dioxide and mixtures thereof to provide a carbon source to convert said first product into iron carbide; (ii) a second component comprising hydrogen gas to inhibit the formation of free carbon in said second product; and (iii) a third component comprising methane to inhibit the back conversion of said iron carbide into metallic iron.

23. A method for converting iron oxide into iron carbide, comprising the steps of:

(a) contacting in a first reaction zone an iron oxide-containing feed material with a first gas comprising hydrogen gas to convert said iron oxide-containing feed material into a metallic iron-containing product; and

(b) contacting in a second reaction zone said metallic iron-containing product with a second gas to form an iron carbide-containing product, wherein said second gas comprises: (i) a component selected from the group consisting of carbon monoxide, carbon dioxide, and mixtures thereof to provide a source of carbon in the formation of iron carbide and (ii) methane to inhibit the back conversion of iron carbide into metallic iron.

41. A method for producing iron carbide, comprising the steps of :

(a) first contacting an iron-containing feed material with a first gas comprising hydrogen and carbon to produce a first product comprising metallic iron, wherein said first product contains no more than about 35 percent by weight iron carbide; and

(b) second contacting said first product with a second gas to produce a second product comprising iron carbide, wherein said second gas comprises (i) a component selected from the group consisting of carbon monoxide, carbon dioxide, and mixtures thereof to provide a carbon source for the conversion of said first product into iron carbide; and (ii) hydrogen gas to inhibit the formation of free carbon in said second product.